

Dynamic Programming and Business Cycles
IDEA Program
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Problem Set #4
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Due date: Monday, Feb.14th

Problem 1 (Cyclical Behavior of the US Economy). *Replicate table 1.1 from Cooley's "Frontiers of Business Cycle Research" (extend the sample to account for the last 20 years of additional information). Consider only the main variables: output (GNP), consumption expenditures (CONS), investment (INV), labor input (HSHOURS and ESHOURS) and average hourly earnings (WAGE). In order to do so, you have to proceed as follows:*

1. *Retrieve quarterly data for the US economy from an on-line resource, such as FRED II (<http://research.stlouisfed.org/fred2/>) or the Bureau of Economic Analysis (<http://www.bea.gov/>)*
2. *Compute the trend of each of the series (in logs) using an appropriate filter (such as the Hodrick-Prescott Filter). Get the cyclical component of each series using the calculated trend*
3. *Calculate standard deviations and cross-correlations of these cyclical components*

Compare your results when you perform the same exercise but using a linear trend as the trend instead of the Hodrick-Prescott Filter.

Problem 2 (Value function iteration and shocks to technology). *Write a program to solve the stochastic growth problem WITHOUT leisure choice, using value function iteration. The process for shocks is a 3-state markov chain, where $z = \{1/(1.1), 1, 1.1\}$ and the transition matrix Γ is a 3×3 matrix equal to $1/3$. For the functional forms, consider log utility and a Cobb-Douglas production function with a capital share equal to $1/3$. Take $\beta = 0.99$ and $\delta = 0.012$. After finding the optimal policies, replicate table 1.2 from Cooley. Specifically:*

- *Create a fictional history for an exogenous shock $\{e_t\}_{t=t_0}^T$, distributed uniformly between 0 and 1, where t_0 is the first date of your sample and T is the last one*
- *Given the exogenous shocks and the 3-state markov chain above, write a program that translates the sequence of shocks into a sequence of $\{z_t\}_{t=t_0}^T$. How would you change Γ to get a more correlated shock process?*
- *Using the optimal policies, simulate paths for all endogenous variables in the model and produce statistics as in **Problem 1***
- *Repeat this procedure 100 times and get the average and standard errors for all statistics across simulations*